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SHORT NOTE

People's perceptions of crocodiles in Nigeria

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Throughout Africa, feelings towards crocodiles vary according to the danger or fear experienced by communities living alongside them. Crocodile conservation programs must therefore be based on reliable assessments of cultural attitudes towards these reptiles. In this study, we interviewed a random sample of 300 persons in six states in southern Nigeria to determine their perception of crocodiles. Our results revealed that most respondents were very familiar with crocodiles, animals being regularly sighted but only in small numbers. Most interviewees were aware of just two crocodile types, consistently describing the dwarf crocodile (*Osteolaemus tetraspis*) and the West African Nile crocodile (*Crocodylus [niloticus] suchus*); only a minority of respondents reporting they were aware of the West African slender-snouted crocodile (*Mecistops cataphractus*).

Keywords: *Crocodylus*; *Osteolaemus*; *Mecistops*; Local Ecological Knowledge; conservation; West Africa

In most tropical regions, crocodiles and other reptiles are important as food and traditional medicine, as well as for clothing or ornaments (Alves et al., 2006, 2008, 2009, 2013). Wherever crocodilians occur alongside humans, peoples' attitudes towards these animals may vary from indifference to antagonism. Crocodiles can provide direct benefits through their sustainable use, especially via the skin trade (Webb et al. 1987). But, local communities may be convinced to protect these large predators because they are thought to play an important role in maintaining the productivity and diversity of wetland ecosystems (van der Ploeg et al. 2011). Cultural and intrinsic values for protecting crocodiles can also be strong motivational reasons to be used when developing crocodile management plans (Pooley, 2016). In West Africa, crocodilians alongside snakes and chelonians, are also central to many cultural beliefs (Ben-Amos, 1976; Fretey et al., 2007). However, depending on the level of conflict between crocodiles and humans, attitudes towards the conservation of these reptiles may differ, as shown in rural communities in Benin experiencing distinct levels of human-crocodile conflict (Kpéra et al., 2014).

Rural peoples living in close proximity to crocodiles West Africa often revere and protect them from harm. In some countries, this is due to their belief that, just as water is essential to crocodiles, crocodiles are crucial for water, since this would permanently disappear if they were not there (Kpéra, 2003; Kpéra et al., 2004). Although there are records of the folklore surrounding crocodiles in West Africa (Kpéra et al., 2014), our knowledge of the nature of the relationship between human

communities and crocodiles is still fragmentary (e.g. Anadu & Oates, 1982; Powell, 1993, 1995; Akani et al., 1999; Pooley, 2016). Although knowledge of the ecology of crocodiles in West Africa (Shirley et al., 2009, 2018), and primarily in Nigeria is growing (Luiselli et al., 1999a, 1999b, 2012), there are few studies assessing people's perception of the presence and abundance, or their value as a source of food or income. This information, as Kpéra et al. (2004) have shown, can be used to improve the management of these species e.g. in turning traditional uses of crocodiles for medicines into a sustainable industry in Benin.

Although in-depth interviews involving intensive individual interviews with a small number of respondents are ideal, here we use shorter interviews applied to a large number of people to determine attitudes and knowledge of crocodilians in southern Nigeria. These interview campaigns were used to gather indirect data of conservation and biological interest (Huntington, 1997).

Between March and May 2014, we interviewed different people in seven states in southern Nigeria (Oyo, Edo, Delta, Bayelsa, Rivers, Akwa-Ibom and Cross River). These states are characterized by a network of rivers, streams and water basins (mostly within the Niger Delta region), most of them inhabited by crocodiles (e.g., Luiselli et al., 2012). The banks of rivers and streams are lined by gallery forests in the freshwater tracts and by mangroves in the brackish water expanses. There are extensive agricultural areas and large urban centres in the region (the largest city being Port Harcourt), and the overall human population is well over 10 million people (e.g., Luiselli et al., 2012). Based on previous visits in which we collected data on the presence of crocodiles in their surroundings, we selected a sample of villages and towns in each state to interview people (see below for the details). In these localities, we applied semi-structured face-to-face interviews, consisting of eight questions as follows:

- 1) Have you ever seen a crocodile in Nigeria?
- 2) Where did you see crocodiles in Nigeria?

3) When was the last time you saw a crocodile in Nigeria?

4) How many crocodiles did you see?

5) In what condition did you see the crocodiles?

6) How many types of crocodiles do you know?

7) Do you know any community or area where crocodiles exist but are not hunted or killed?

8) Do you know any community or area where crocodiles exist but are hunted or killed?

Interviewees were selected by randomly picking persons in marketplaces, canteens, restaurants, roadsides, hairdressing salons, food shops, and other gathering places. This random selection procedure consisted in stopping the first person met after a given time period (in minutes), with the time interval randomly generated by a Random Number Generator. Local scientists applied all interviews in the local language. Interviewed persons were informed of the aims of the project beforehand and were asked for their verbal consent before proceeding. No minors (<18 years) were approached. All interviews followed the ethical recommendations of the British Sociological Association. Each interview lasted about 15 minutes on average.

During each interview, we noted the interviewees' gender (male or female) and age (18 to 25 years, 26-50 years, ≥ 51 years) but not their names to ensure anonymity (St. John 2010; Nuno et al. 2014; Luiselli et al. 2017). To avoid non-independence of data, we did not question persons of the same family or those living in the same house, even if they were not relatives (see also Hema et al., 2017). A total of 300 people (241 men; 59 women) were interviewed.

Frequency differences between types of answers were analysed using a χ^2 test, performed by Past 3.0 statistical software, with alpha set at 5%. All analyses were done with the software "Past 3.2 version".

Question 1. Valid cases were 299, with 277 'yes' and 22 'no' as answers. There was a statistically significant difference between the frequencies of the two answers ($\chi^2=217.47$, $df = 1$, $P < 0.0001$).

100 *Question 2.* The different answers provided by interviewees are summarized in Fig S1. In this case,
 101 275 valid cases were retained for analysis. There was a significantly uneven distribution of the
 102 various answers ($\chi^2=109.16$, $df = 4$, $P < 0.0001$), with the majority of answers being 'wild' and
 103 "park/zoo". Interestingly, a relatively low percentage of people (7.7%) answered 'market' (Fig.
 104 S1a).

105 *Question 3.* A total of 255 valid cases were retained for this question. There was a significantly
 106 uneven distribution of the various answers ($\chi^2=144.88$, $df = 4$, $P < 0.0001$; Fig. S1b), with a greater
 107 majority of answers being '1-5' years.

108 *Question 4.* A total of 269 valid answers were retained for this question, providing a statistically
 109 uneven distribution of answers ($\chi^2=547.6$, $df = 4$, $P < 0.0001$; Fig. S1c). Almost three quarters of
 110 people interviewed have seen less than five crocodiles (Fig. S1c), with no significant frequency
 111 differences among the surveyed states of Nigeria ($\chi^2=4.6$, $df = 6$, $P = \text{n.s.}$).

112 *Question 5.* Out of 267 valid cases retained for analysis, 94.4% of respondents mentioned that they
 113 saw crocodiles 'alive', 2.6% 'dead', and 3.0% as 'skin'.

114 *Question 6.* In total, 249 valid cases were retained. Most interviewees answered that they have seen
 115 two types of crocodiles (Fig. S1d), and consistently described the dwarf crocodile (*Osteolaemus*
 116 *tetraspis*), locally known as alligator in Pidgin English, and the West African Nile crocodile
 117 (*Crocodylus [niloticus] suchus*). Conversely, a small proportion of respondents (< 5%) reported that
 118 they are aware of the West African slender-snouted crocodile (*Mecistops cataphractus*), whereas
 119 the fourth type of "crocodile" mentioned is the forest monitor lizard (*Varanus ornatus*); because of
 120 its swimming attitudes, this animal is sometimes considered a crocodile.

121 *Question 7.* Out of a total of 144 valid cases, 86 people answered 'no' and 50 answered 'yes'. The
 122 location of traditional veneration areas for crocodiles was, according to respondents of our
 123 questionnaires, quite widespread, with areas in the south-west (Edo State), south-east (Cross River
 124 State) as well as in northern areas of the country (Borno State) (Figure 1).

125 *Question 8.* Out of a total of 115 valid cases, a large majority of people (n = 79) people answered
 126 'no' and only 36 answered 'yes' (Figure 2).

127

128 Our interviews revealed that most people were familiar with crocodiles, with wild and park/zoo
 129 animals being the usually observed individuals. Interestingly, as the majority of respondents
 130 claimed to have seen crocodiles in recent years and in the wild, this suggests that crocodiles are still
 131 frequently encountered by people in southern Nigeria. However, pooling the outcomes of question
 132 4) with the results for question 3, it becomes evident that in recent years most interviewees saw
 133 crocodiles, but in small numbers, suggesting that crocodiles are still widespread but relatively rare
 134 in southern Nigeria.

135

136 Most respondents claimed that they saw live crocodiles not dead specimens. Although the term
 137 alive could refer to living animals in different situations not just in the wild (many crocodiles are
 138 traded alive in bushmeat markets, see Fig. 3), it is likely that some specimens reported alive by our
 139 interviewees were just ready to be killed, and in any case not going to be released to the wild. Most
 140 crocodiles observed were *O. tetraspis* and *C. [niloticus] suchus* but our results indirectly indicate
 141 that *M. cataphractus* is extremely rare. The perception that our interviewees had of the three
 142 crocodile species mirrors available field data collected during the last twenty years in southern
 143 Nigeria. *M. cataphractus* is very rare in the whole of West Africa with very few records for Nigeria
 144 (Shirley et al., 2009; Shirley et al., 2018), whereas *O. tetraspis* and *C. [niloticus] suchus* are still
 145 widespread and locally abundant, especially in the remote wetlands of the Niger Delta region
 146 (Luiselli et al., 2012). In the Niger Delta area, Luiselli et al. (2012) collected 94 records of *C.*
 147 *[niloticus] suchus* and 344 records of *O. tetraspis*. The findings of our interviews reinforce the
 148 value of "Local Ecological Knowledge" (LEK, sensu Padmanaba et al., 2013; Turvey et al., 2015)
 149 as reliable when contrasted with scientific data collected in the field (Luiselli et al., 2018).

150 Our study has also shown that traditional veneration of crocodiles is not exceptional in Nigeria, an
 151 attribute that can be used to guide potential conservation programs, as in our parts of the world (e.g.
 152 Philippines, van der Ploeg et al. 2011).

153

154 We observed that relatively few persons were able to answer with a precise locality where
 155 crocodiles are hunted or venerated. We think that this relatively low percent of people depended on
 156 that, once arriving to a market for being sold, the provenance of a crocodile is not a matter of
 157 interest for customers, thus many people did not ask where the animal were hunted and therefore it
 158 remains unknown to them where exactly human communities still hunt for wild crocodiles. Overall,
 159 the distribution of answers would indicate that hunting areas for crocodiles are still quite
 160 widespread, with areas in south-west (Edo State), south-east (Cross River State) as well as in
 161 northern areas of the country (Borno State) (Figure 2). It must be noted that there was a wide
 162 overlap between areas cited in Figure 1 and Figure 2, thus showing that veneration and hunting may
 163 coexist at fine spatial scales. Therefore, for conservation planning, it is necessary to have a fine-
 164 scale knowledge of the traditions and culture of local communities if we want to make efficiently
 165 the management of the local crocodile populations, and further studies on the cultural attitudes of
 166 humans towards crocodiles are strongly needed in this region of West Africa. In particular, since a
 167 suite of different variables influences behaviour (attitudes, perceptions, norms, perceived control
 168 etc., Marchini & McDonald, 2012), a fuller study of factors influencing human behaviour should be
 169 studied if we want to efficiently manage the crocodile populations in the whole region.

170

171 From a geographical point of view, our data suggest that the Rivers State is the most important for
 172 crocodile protection and long-term survival since interviews from this area not only generated a
 173 high number of localities in which at least two species (*C. [niloticus] suchus* and *O. tetraspis*,
 174 possibly also *M. cataphractus*) were found but also several sites that included “traditional

175 protection". Conversely, Borno State appears as the area where crocodiles are most hunted and
 176 therefore of special conservation concern for crocodiles.

177

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 183 followed the ethical standards accepted by the British Sociological Association and did not involve
 184 any minors.

185

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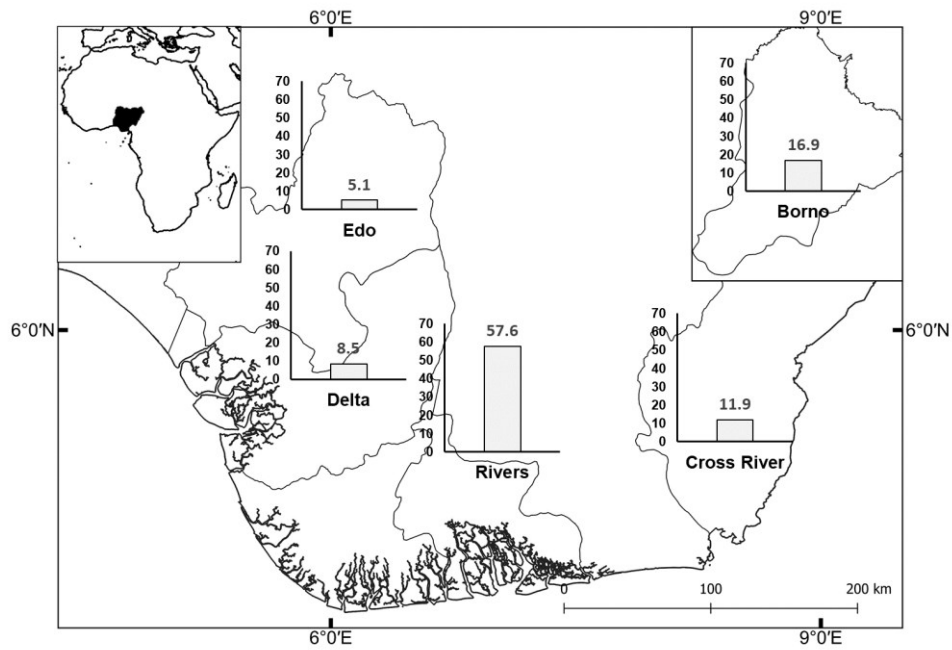
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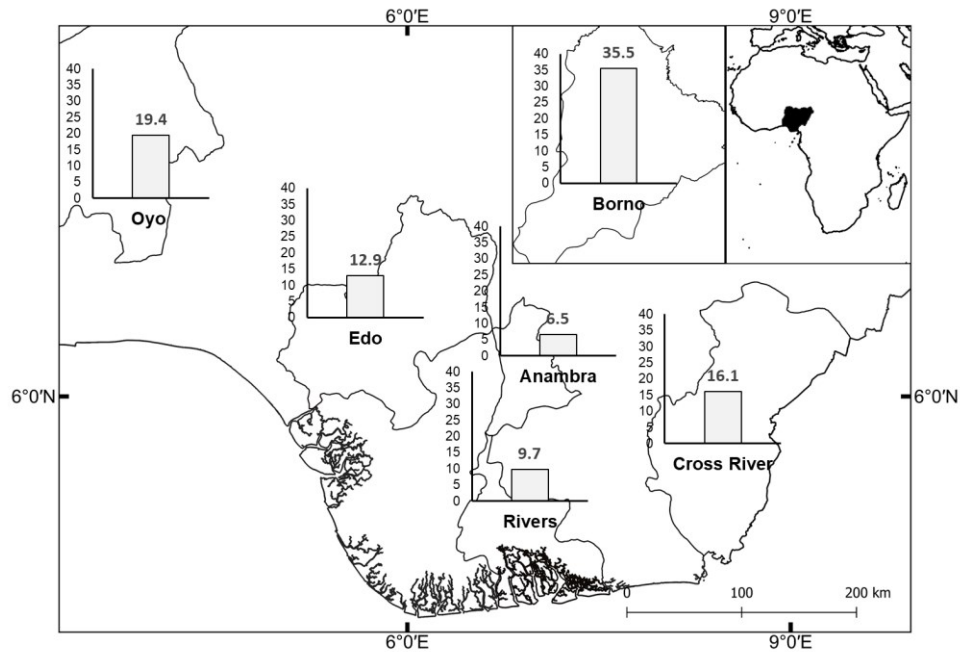
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267 **Figure 1.** Map of Nigeria showing, by State, the valid percentages of answers on the question: “Do
 268 you know any community or area where crocodiles exist but are not hunted or killed?” Valid
 269 percent would indicate the percentage calculated, for a given answer, only to the people who gave
 270 an answer (thus excluding the “no answer” cases).



273 **Figure 2.** Map of Nigeria showing, by State, the valid percentages of answers on the question: “Do
 274 you know any community or area where crocodiles exist but are hunted or killed?” Valid percent
 275 would indicate the percentage calculated, for a given answer, only to the people who gave an
 276 answer (thus excluding the “no answer” cases).



280 **Figure 3.** Dwarf crocodile (*Osteolaemus tetraspis*) still alive while being sold at Edumanom
281 market, Bayelsa State (Nigeria).



282